Fusion3

EDGE 3D Printer
F200 3D Printer

TROUBLESHOOTING: HEATER FAULTS

Revision 6/25/2025

HEATER FAULTS & HOW TO TROUBLESHOOT THEM

Heater faults are a common issue you may run into, and have a myriad of potential root causes. This is a complex topic, and this document is **not** intended as a comprehensive guide on how to fix all heater faults. Our intent with this document is to give you the information to understand *what* a heater fault is, *why* it might have happened, and perform some of the first steps to troubleshoot and fix the issue. If you can't fix your issue on your own, reach out to our support team - that's why we're here!

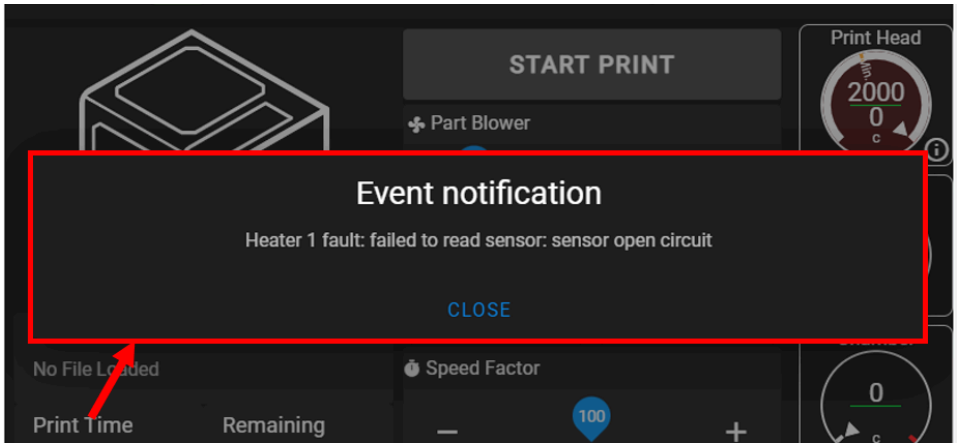
WHAT IS A HEATER FAULT?

Your Fusion3 printer contains sophisticated safety logic in the firmware that monitors both the print head and the bed for potentially unsafe conditions. A heater fault is what happens when an event or state occurs that violates the safety parameters of this monitoring logic.

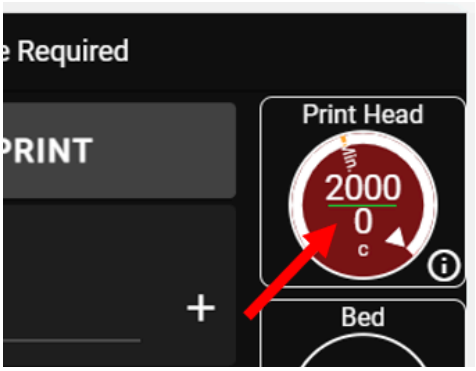
WHAT HAPPENS WHEN THE PRINTER DETECTS A HEATER FAULT?

Your printer will do several things to put the printer into a safe state and alert you that there's an issue:

- If a print is running, it will pause the print
- It removes power from the heater in question
- It locks the heater out, so it can't be re-energized without the operator acknowledging that a fault happened.
- It puts a notification window on the screen



- It turns the temperature dial on the display pulsing red



- It generates an error message on the console

TYPES OF ERRORS THE PRINTER WILL REPORT

Heater faults encompass four specific types of errors:

- Circuit disconnected / open circuit
- Short circuit
- Temperature rising more slowly than expected
- Temperature excursion exceeded X°C

We'll explain each of these faults in detail below.

(Updated June 2023) In newer firmware, we've made heater fault error reporting more verbose. Here's some information on what different error codes mean. At the end of the error message, you will see a text string that says ":: #", where "#" is a number 0-4:

0 = failed to read sensor

1 = temperature rising too slowly

2 = exceeded maximum allowed temperature excursion (this can be either too low or too high)

3 = heater monitor was triggered (this means we exceeded max allowable temperature of 320°C)

4 = unknown error

Circuit Disconnected / Open Circuit

This type of fault occurs when the printer's control board loses its electrical connection with the temperature sensor. This can occur if the sensor gets unplugged, or if a wire between the sensor and control board breaks.

With this fault, the print head will report 0 or 2000°C, and the bed will report 0°C.

If the open circuit is intermittent, you might see this error, but when you check on the printer later you see a "real" temperature on the screen.

Short Circuit

This type of fault occurs when the sensor's circuit becomes shorted and reads 0 ohms.

The temperature sensors on your printer are basically resistors whose resistance changes with temperature, so if the circuit suddenly reads 0 ohms, the control board is able to detect this and understand it's not a real temperature reading.

This type of fault is rarer than open circuits, since breaks or damage to wiring usually result in open circuits, not shorts.

With this fault, you will see a very high reported temperature on the screen.

Temperature Rising More Slowly Than Expected

To explain this error we have to explain part of the safety logic. In the firmware there is a mathematical model of the heater. This means that the controller is able to predict how quickly the heater **should** heat up or cool down, given the current temperature and some other variables. If what it measures departs too far from the model for more than a certain length of time, it says "*Oh, my actual performance has departed significantly from my model of how this heater should work. This means something must be wrong*" and generates this error.

This logic is important because it can catch problems that monitoring for short circuits or disconnects won't, like if the sensor comes out of the print head but remains electrically connected.

This error message usually occurs during the initial heating phase, but it can also occur if a large change in the heater set point is sent during a print.

This logic can also generate false positives. The most common false positive is if the print cooling blower runs too fast for a certain print condition (very high print head temperatures, very high flow rate, or too close to the bed), which causes the print head's behavior to depart from the model, even if nothing is wrong. Usually the fix here is to adjust your slicer settings to prevent the blower from turning on too early in the print.

Temperature Excursion Exceeded X°C

The safety logic also looks for dips or jumps in the actual temperature more than X degrees away from the set point. If it sees one, it generates this error message.

Sometimes, a thermal issue caused by the blower, like we described in the last section, will cause this error message instead.

It's also possible for a **very** intermittent open circuit to cause this error instead, but this is pretty rare.

FIRST STEPS TO DIAGNOSE / FIX THE FAULT

If you encounter a heater fault on your printer, here are the first steps to follow to gather information and begin to fix the issue.

A heater fault can occur on either the bed or the print head (print head is more common). These steps apply to both.

- A BED heater fault will say "*heater 0*".
- A PRINT HEAD heater fault will say "*heater 1*".

1) Check the Console for More Information

Go to *Utilities > Console* and see what additional information your printer has given you about the fault. You should see an error message that corresponds to one of the fault types in the previous section.

2) Check the Temperature Readout

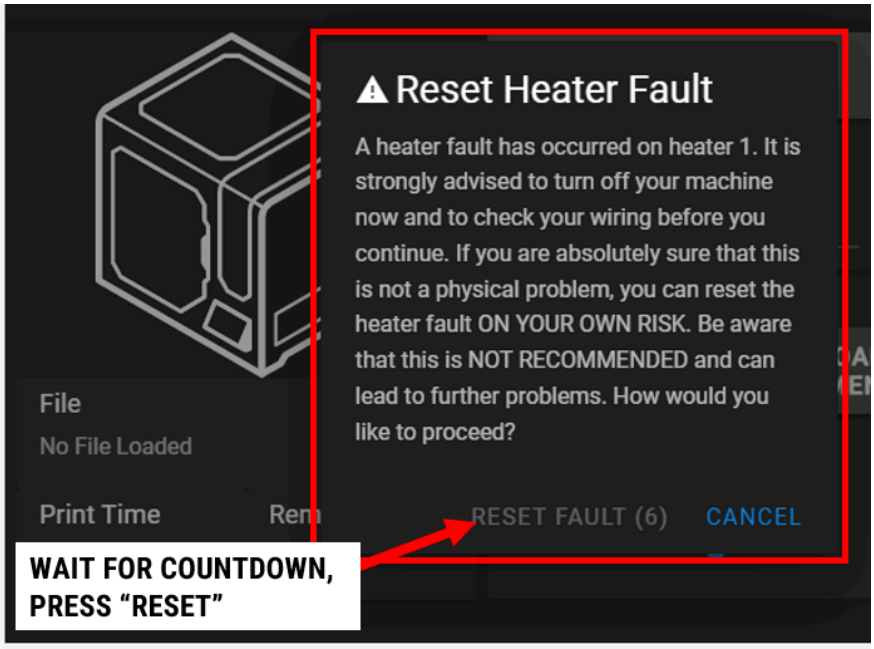
Determine if the sensor is still showing a fault by checking the temperature readout dial.

If the temperature readout is **normal**, continue with the steps below.

If the temperature readout consistently shows the fault, cancel your print and address the issue.

3) Attempt to Resume Your Print

If this is the first time the fault has happened, our first goal is to see if it happens again. Some faults are intermittent and don't need to be fixed if they don't show up again.


Reset Heater Fault
A heater fault has occurred on heater 1. It is strongly advised to turn off your machine now and to check your wiring before you continue. If you are absolutely sure that this is not a physical problem, you can reset the heater fault ON YOUR OWN RISK. Be aware that this is NOT RECOMMENDED and can lead to further problems. How would you like to proceed?
File
No File Loaded
Print Time
RESET FAULT (6)
CANCEL
WAIT FOR COUNTDOWN, PRESS “RESET”

1. Press on the temperature dial with the fault. A dialog box will pop up that says this heater has a fault, it's possible to reset, but not recommended.
2. Wait 10 sec before it lets you reset the fault.
3. Press "*reset fault*".
4. Press the temperature dial and set it back to your printing temperature. Wait for it to heat up.
5. Once it's up to temperature, press "*resume print*".
6. Lastly, go to the *Utilities* > *Temperature Chart* screen so we can see the recent history of the temperature readouts. This is an invaluable tool for diagnosing what type of fault you have.

4) Monitor the Printer Closely

DO NOT leave the printer unattended for the next hour! We want to be nearby if the heater fault happens again, so we can see what is going on in real time.

If the fault happens again, we've established there is actually a problem that needs to be addressed. You should plan to lose the print vs trying to get it to finish.

If the fault happens again:

1. Take a picture of the Temperate Chart screen, and send it to us if you need help fixing your fault.
2. Download a copy of your console log (instructions HERE) and send that to us as well.

ROOT CAUSES OF HEATER FAULTS

This section describes some of the root causes of heater faults. This is not a comprehensive list, but it's the most common known causes. They're listed in approximate order of most-common to least-common.

Sensor Has Broken/Failed

Can manifest as: All fault types

Can be intermittent failure or reports wrong temperature, but this is rare for PT1000 (vs thermistor).

In general the bed sensor is less prone to issues since it moves around less, is better mechanically protected, and operates in a lower temperature range.

- (Both) Sensor wears out from old age
- (Print head) Sensor connected to print head heater output at the breakout PCB and 24V applied. If you just serviced the print head or replaced the heater/sensor and it immediately fails, this is probably what happened.
- (Print head) Wire pigtail on the sensor damaged/broken.

Broken Wiring - Sensor Circuit

Can manifest as: Open circuit, short circuit (rare)

(Print head) Can manifest as an intermittent error that only happens during a print, when the print head is in motion. (EDGE only) Usually caused by damage to the 8 pin harness. More info HERE. It's possible, but very rare, for the wiring inside the electronics bay to be damaged as well.

(Print bed) The sensor wire leading from the bed to the control board is damaged. This wire is contained in the flexible mesh sleeve.

Broken Wiring - Heater Circuit

Can manifest as: Temperature rising more slowly OR excursion exceeded

This is pretty self-explanatory: If the heater can't get power, the bed/head isn't going to heat up and it'll generate an error.

- If this happens during initial heat up, you'll see a "rising more slowly" error.
- If this happens during a print, you'll see an "excursion exceeded" error.

Short Between Heater, Print Head OR Bed Heater and Toolplate

Can manifest as: All error types, or other strange non-heater errors

In this situation, the heater is damaged and is electrically connected to something it shouldn't be. This can energize the print head assembly (or the bed tool plate) to 24V, if the positive voltage wire is damaged. This can cause a number of very strange behaviors:

- Heating errors (usually rising more slowly)
- Strange behavior during the nozzle offset or bed probing sequence, since these inputs rely on 5V signals to determine when a circuit is open or closed. This can make these processes fail entirely or just deliver bad data.
- Sometimes this will cause the electronics to lock up or reboot.
- It's very rare, but possible, for damage to the electronics to occur.

In order to troubleshoot and resolve this, you'll need our help. If you think this is what you're dealing with, please get in touch.

Thermal Issue

Can manifest as: Temperature rising more slowly OR Excursion exceeded

A thermal issue is when a heater fault is caused by too much thermal demand being placed on the heater in order for it to remain at its set point.

For the print head: This can be caused by the print cooling blower running too aggressively for print conditions (very high print head temperature, very high flow rate, or too close to the bed). It can also be caused by the blower being damaged or out of position, and leaking cold air directly onto the hot side, instead of directing it down towards the print.

For the bed: This can be caused by placing a cold print surface onto the tool plate while it's heating up. Especially if you used cold shock (placing the glass + printed part in a freezer) to remove your part, then immediately place the cold glass back on the bed. Usually, once the tool plate is up to temperature, it can accommodate a cold surface being placed on it without erroring out.

Heater faults caused by this root cause require changes in print settings or operator behavior to resolve them (unless your blower duct is damaged).

- Make sure the blower isn't running too aggressively (this can also be a clue you need to run multiple copies of your very small part in the same print).
- Decrease print speed or reduce flow rate.

Damaged Board Input (Sensor Input)

Can manifest as: All error types

This is one of those root causes that you look after you've ruled out the sensor and wiring. This is pretty rare, but for the sake of completeness we're listing it.

You can test the sensor inputs by connecting a resistor to the input directly:

- Print head: 1kohm
- Bed: 100kohm

The inputs should read ~room temperature with these resistances.

Damaged Board Output

Can manifest as: Temperature rising more slowly

This basically manifests the same as the heater power wires being broken. In some *very rare* cases you may have a weird situation where partial power is applied to the heater, vs 0v or 24v, but this will still error out the same way.

If you've replaced all the wiring and the heating element and it's still not working, this is work checking.

GETTING OUR HELP

How to most effectively help us help you.

Here's a checklist of information we're going to need to help you fix your heater faults. When you reach out to our support team, please have this information ready.

- Console log (INSTRUCTIONS)
- Description of the type of fault (pictures of the fault message are good!)
- Picture of the *Utilities > Temperature Chart* showing the fault.
- Description of what you have tried so far, so we don't duplicate effort.
- Brief description of when the fault happens during operation (during heatup, during beginning-of-print sequence, early in a print, randomly later in a print).

How to Contact Us

Email: support@fusion3design.com

Support form or schedule a video call: https://www.fusion3design.com/contact-support/